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Financial Literacy and Financial Wellbeing: Dual Capability Pathways and Contextual Moderation in Portugal

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Abstract

This study examines how two forms of financial literacy—objective financial literacy (OFL; demonstrated knowledge of interest rates, inflation, and diversification) and perceived financial literacy (PFL; self-assessed confidence in financial matters)—relate to financial wellbeing through distinct capability pathways, and whether self-regulation conditions these links. We use three nationally representative cross-sections from Portugal (2015, 2020, 2023; $N = 3648$), a European setting marked by declining objective literacy and constrained market participation. Guided by capability theory, we propose a dual-lane model in which OFL operates through behavioural capability (BC; enacted saving, investing, and planning behaviours) to shape objective financial wellbeing (OFW; resilience, assets, and saving), while PFL operates through perceived capability (PC; financial self-efficacy and perceived control) to shape subjective financial wellbeing (SFW; perceived security, satisfaction, and freedom from financial stress). We also test whether non-impulsive, future-oriented behaviour (NIB) strengthens the associations along the objective lane. Structural equation models provide partial support for the dual-lane model, revealing three asymmetries with implications for European policy: (1) the link between behavioural capability and objective financial wellbeing weakens in 2023, suggesting that macroeconomic conditions can undercut even prudent financial behaviour; (2) perceived financial literacy directly predicts subjective financial wellbeing, but perceived capability does not mediate this association, indicating that financial confidence shapes wellbeing independently of self-efficacy; and (3) non-impulsive, future-oriented behaviour amplifies the association between objective literacy and objective wellbeing in 2015 and 2023 but not in 2020, showing that the benefits of self-regulation are context-dependent. The findings inform financial education and policy across Europe by distinguishing intervention levers for objective versus subjective outcomes and identifying conditions under which behavioural interventions are most effective.

Keywords: financial literacy; financial capability; financial wellbeing; associational pathways; non-impulsive behaviour

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1. Introduction

Individuals in advanced and emerging economies now manage day-to-day finances, long-term saving, and risk themselves, but many lack the conceptual knowledge or fail to act on what they know. Financial literacy, measured by questions on interest compounding, inflation, and diversification, is unevenly distributed. Higher literacy consistently predicts behaviours such as retirement planning, which correlate with better financial outcomes (Lusardi & Mitchell, 2011). In the 2021 National Financial Capability Study, fewer than one-third of U.S. adults answered three basic financial literacy questions correctly; younger, less educated, and non-employed groups scored lowest (Lusardi & Streeter, 2023). Overconfidence is also common: those with the least knowledge tend to rate their literacy highest, which hinders action. Bibliometric analysis shows a sharp rise in publications on financial literacy, capability, and behaviour since 2010 (Shi et al., 2024).

The financial capability perspective holds that knowledge alone does not suffice. People need both the ability to act (skills, confidence, and self-efficacy) and the opportunity to act, meaning access to suitable financial products and supportive institutional condition (Sherraden, 2013). In policy and practice, financial wellbeing has become the central outcome. It has two complementary forms: *subjective financial wellbeing* (*SFW*) refers to perceived control, security, and goal progress; *objective financial wellbeing* (*OFW*) refers to tangible conditions such as assets, financial resilience, and regular saving (Consumer Financial Protection Bureau, 2015). This distinction echoes earlier capability frameworks that separate day-to-day money management from planning and product use (Atkinson et al., 2007). Recent European research confirms that financial wellbeing is empirically distinct from both general life satisfaction and objective literacy measures. Collins and Urban (2020), using UK panel data, show that financial wellbeing captures subjective financial status and perceived future trajectory as a separate construct in household finance research, not a proxy for economic resources or general wellbeing.

Financial wellbeing is commonly defined as comprising current financial stress, expectations about future security, and the capacity to meet ongoing commitments (van Raaij et al., 2023). Research linking this construct to work on financial literacy and capability shows that literacy often is associated with wellbeing through behavioural or psychological mechanisms rather than through direct knowledge effects (Sabri et al., 2022; Tahir et al., 2021). Reviews consistently identify everyday financial behaviour and perceived capability as the strongest proximal predictors of wellbeing, whereas objective knowledge shows weaker and less stable associations (Singh & Malik, 2022). Related studies treat financial literacy as one element of a wider capability set shaped by behaviour and access to financial resources (Xiao et al., 2022). Some evidence also shows that higher literacy can coincide with overconfidence or risk-taking when psychological constraints or contextual limitations restrict the use of knowledge (Saeedi & Nishad, 2024).

Psychology-informed work identifies self-regulation, especially the contrast between impulsive and future-oriented tendencies, as a major determinant of money management. Numeracy, inhibitory control, and sensitivities to numerical cues affect how individuals interpret financial information and carry out routine financial tasks (Skagerlund et al., 2018). Meta-analytic findings show that impulsivity is positively related to over-indebtedness, indicating that short planning horizons weaken the translation of information into prudent behaviour (Frigerio et al., 2020). Moderated-mediation analyses further show that when *non-impulsive, future-oriented behaviour* (*NIB*) is stronger, literacy predicts capability and wellbeing more effectively (Tahir et al., 2021). Other studies report that perceived capability is often more strongly related to wellbeing than objective knowledge, implying that confidence and perceived control play a substantial role (Fan & Henager, 2022).

These strands of evidence support a dual-path model. *Objective financial literacy* (*OFL*) is expected to be associated with objective wellbeing mainly through *behavioural capability* (*BC*), whereas *perceived financial literacy* (*PFL*), a self-evaluated confidence-based measure, tends to influence subjective wellbeing through *perceived capability* (*PC*). These pathways reflect differences between behavioural and perceptual components of capability and between objective and subjective dimensions of wellbeing, while still allowing for limited direct effects of literacy (Consumer Financial Protection Bureau, 2015; Sherraden, 2013). Because the conversion of knowledge into behaviour depends on self-control and a future time perspective, *NIB* should be associated with stronger $OFL \rightarrow BC \rightarrow OFW$ pathways (Frigerio et al., 2020; Tahir et al., 2021).

Several gaps remain. Much research analyses literacy or capability separately rather than examining objective and perceived literacy within a common framework (Lusardi & Mitchell, 2011; Sherraden, 2013). Few studies distinguish objective and subjective wellbeing while mapping how each relates to literacy and capability, despite conceptual models treating them as separate constructs (Atkinson et al., 2007; Consumer Financial Protection Bureau, 2015). Self-regulation is often treated as a stable trait rather than a moderator shaping the conversion of literacy into capability and wellbeing, even though evidence shows that impulsivity and future orientation condition these links (Frigerio et al., 2020; Tahir et al., 2021). Furthermore, many findings come from single-wave or context-specific datasets, limiting understanding of whether these pathways persist when economic conditions or household constraints change (Sabri et al., 2022; Singh & Malik, 2022).

This study examines a two-lane moderated-mediation model using three independent survey waves (2015, 2020, 2023). The analysis estimates how *OFL* and *PFL* relate to *BC* and *PC*, and how these capabilities correspond to *OFW* and *SFW*. The specification includes theory-consistent partial direct effects of literacy on wellbeing and tests whether *NIB* moderates the $OFL \rightarrow BC \rightarrow OFW$ pathway. The multi-wave structure allows assessment of whether these relations remain stable or vary with shifts in macroeconomic conditions. The design extends prior evidence that literacy predicts specific financial behaviours (Lusardi & Mitchell, 2011) and that capability mediates links between literacy and wellbeing (Sabri et al., 2022; Tahir et al., 2021), while integrating findings on self-regulation.

This study makes three contributions to the financial literacy and wellbeing literature. First, it advances a dual-lane theoretical model that jointly estimates objective and perceived financial literacy within a single structural framework, mapping each to a distinct capability mechanism and a distinct wellbeing outcome. Existing research tends to treat these as separate lines of inquiry; integrating them allows direct comparison of the two pathways and clarifies where each type of literacy, and each type of intervention, is most consequential. Second, it treats non-impulsive, future-oriented behaviour (NIB) as a moderator of the objective literacy–capability–wellbeing pathway rather than a stable individual trait, showing that self-regulation amplifies the returns to financial knowledge under some macroeconomic conditions but not others. Third, the repeated cross-sectional design spanning 2015, 2020, and 2023 introduces a macroeconomic contingency perspective that single-wave studies cannot provide: the same structural model is estimated under meaningfully different economic conditions, revealing which associations are robust and which are context-dependent. Together, these contributions offer a more complete and policy-relevant account of how financial literacy translates, or fails to translate, into financial wellbeing.

Portugal offers a relevant empirical setting. Multi-wave data from 2015 to 2023 document declines in objective financial knowledge and limited engagement in securities markets, patterns that weaken simple assumptions linking higher knowledge to higher market participation (Abreu et al., 2025). Prior analyses show that literacy is associated with participation mainly through financial resilience and that perceived knowledge often

has stronger direct associations with behaviour than objective knowledge. Income and education condition these associations, indicating structural variation in how literacy converts into action. These features underscore the need for a unified framework that incorporates resilience, capability, self-regulation, and differentiated forms of literacy.

Guided by this background, we ask: *To what extent are objective and perceived financial literacy associated with objective and subjective financial wellbeing through behavioural and perceived capability, and is the OFL–capability–OFW pathway conditioned by non-impulsive, future-oriented behaviour across three survey waves?* The question draws on capability theory, multidimensional accounts of financial wellbeing, and empirical work on behavioural mediation and self-regulation.

The article proceeds as follows. Section 2 develops the theoretical background and hypotheses and introduces the conceptual model. Section 3 outlines the methods, including measurement choices, multi-group procedures, and the moderated-mediation design. Section 4 reports the results. Section 5 discusses key findings and their implications, and Section 6 concludes. Variable names and coding are documented in the Appendix A (Table A1).

2. Theoretical Background and Hypotheses Formulation

Financial knowledge predicts several domain-specific behaviours and outcomes, especially retirement planning and preparedness, which has led much of the literature to treat literacy as a precursor of financial behaviour. Capability research, however, shows that knowledge rarely supports daily money management on its own. Skills, confidence, and access to suitable financial products determine whether people can carry out budgeting, saving, investing, and planning tasks. These behaviours provide the channels through which knowledge and opportunities influence both material conditions and perceived security. Recent empirical work confirms that capability and behaviour frequently mediate literacy–wellbeing associations and that the three constructs are distinct but closely related, which necessitates joint estimation.

Consistent with this mediational perspective, subjective capability, short-term financial behaviour, and financial satisfaction show strong direct associations with financial wellbeing. Objective knowledge tends to have weaker or indirect effects once behavioural variables are included. These patterns are consistent with mechanisms outlined in Self-Regulation Theory, which focuses on goal setting, monitoring, and corrective action; the Behavioural Life-Cycle Hypothesis, which emphasises present-bias and the treatment of funds over the life course; and Self-Efficacy Theory, which examines beliefs about one's capacity to carry out financial tasks. Together, these frameworks explain how literacy and psychological traits affect wellbeing directly and through behaviour. Financial hardship constitutes an additional channel: lower self-control and lower self-efficacy are associated with higher hardship, which in turn lowers financial wellbeing, with substantial mediation effects reported for both traits.

Capability research shows that financial capability extends beyond knowledge. It involves carrying out budgeting, saving, investing, and planning behaviours, and having access to products that allow these behaviours to occur. Empirical reviews find that capability, rather than literacy alone, is the variable most consistently associated with household financial outcomes. Additional evidence shows that self-discipline, self-efficacy, and financial attitudes correlate more strongly with behaviour than knowledge does, and that literacy-only interventions rarely produce lasting change without behavioural or contextual components.

European scholarship has increasingly adopted this capability-centred approach. Panos and Wilson (2020), in their introduction to a Special Issue of *The European Journal of Finance*, show that knowledge acquired early in life predicts adult financial wellbeing, illustrating the cumulative and developmental nature of these processes. Their framework treats financial literacy as an initial resource whose effects depend on individual capability and institutional conditions. Portuguese evidence reflects these mechanisms: objective literacy does not adequately account for engagement with complex financial products; resilience mediates literacy–participation links; income and education shape whether households can act on what they know; and perceived knowledge and self-efficacy are closer correlates of participation.

Self-regulation further structures these pathways. Meta-analysis links impulsivity with over-indebtedness, indicating that short time horizons weaken prudent behaviour. Moderated-mediation analyses show that when future orientation is stronger, literacy translates more effectively into capability and, in turn, higher wellbeing. Cross-national evidence also shows differentiated roles for self-regulation components: lower trait self-control aligns with present money-management stress, whereas stronger future orientation aligns with expectations of future security. Both traits operate directly and through everyday behaviours.

Financial wellbeing comprises distinct subjective and objective dimensions. *Subjective financial wellbeing* (*SFW*) refers to perceived control, capacity to absorb shocks, progress towards goals, and scope for financial choice. *Objective financial wellbeing* (*OFW*) refers to observed financial conditions, including resilience and asset positions. Comparative reviews recommend separating financial wellbeing from general economic wellbeing to avoid conceptual blending, and capability mapping delineates the domains through which individuals manage money, plan and interact with financial products.

Taken together, these strands support two pathways: an objective pathway, in which objective literacy is associated with behavioural capability and thereby with objective outcomes; and a perceived pathway, in which perceived literacy is associated with perceived capability and thereby with subjective outcomes. *Non-impulsive, future-oriented behaviour* (*NIB*) conditions the objective pathway by moderating the association between objective knowledge and behaviour and, ultimately, with resilient outcomes.

2.1. Definitions and Hypotheses Formulation

2.1.1. Objective Financial Literacy (OFL)

Objective financial literacy (*OFL*) refers to demonstrated knowledge of interest rates, inflation, risk diversification, and the time value of money, usually measured through standardised test items (Lusardi & Mitchell, 2011). Bibliometric reviews show that questions on inflation, compound interest, and diversification dominate empirical measurement and continue to function as the field's core indicators (Shi et al., 2024). *OFL* is expected to support *behavioural capability* (*BC*) in areas such as saving, investing, and retirement planning. These behaviours contribute to *objective financial wellbeing* (*OFW*) by building resilience and accumulating assets.

Several mechanisms account for this pathway. The Behavioural Life-Cycle framework proposes that literacy facilitates mental budgeting and self-control, allowing individuals to create emergency buffers that make risk-bearing decisions more feasible. The Theory of Planned Behaviour (TPB) identifies perceived behavioural control as a proximal determinant of action, especially in environments where financial choices are complex. Portuguese evidence reflects both mechanisms: resilience mediates literacy–participation links; perceived knowledge shows a stronger direct association with participation than objective knowledge; and income and education condition whether individuals can apply what they know (Abreu et al., 2025).

Recent reviews also document growing attention to discrepancies between objective and subjective knowledge. Subjective financial knowledge and self-efficacy frequently predict prudent behaviour and financial wellbeing even after controlling for objective knowledge, suggesting independent confidence-based effects (Saeedi & Nishad, 2024). European causal evidence strengthens this interpretation. Using instrumental-variable methods on Slovakian household data, Cupák et al. (2019) show that the effect of financial literacy on voluntary retirement saving participation increases substantially when endogeneity is addressed. Their results indicate that the *OFL* → *BC* relationship reflects a causal mechanism rather than a spurious association, supporting theoretical claims that literacy functions as a precursor to behavioural capability. Hence,

H1a. *OFL is positively associated with BC, and BC is positively associated with OFW (forming an indirect association OFL → BC → OFW).*

2.1.2. Perceived Financial Literacy (PFL)

Perceived financial literacy (*PFL*) refers to self-assessed knowledge and confidence in handling financial matters. Systematic reviews show that *PFL* often has stronger associations with financial behaviour than objective literacy (Shi et al., 2024). Because self-beliefs about financial competence are associated with whether individuals attempt or persist with financial tasks, *PFL* is expected to be positively associated with *perceived capability* (*PC*) (financial self-efficacy) which in turn supports *subjective financial wellbeing* (*SFW*) through higher perceived control, reduced worry, and greater satisfaction. Empirical studies identify consistent behavioural and perceptual mediation between literacy and wellbeing (Sabri et al., 2022). Hence,

H1b. *PFL is positively associated with PC, and PC is positively associated with SFW (forming an indirect association PFL → PC → SFW).*

2.1.3. Behavioural Capability (BC) and Perceived Capability (PC)

Capability theory holds that competent financial behaviour requires both the ability to act and the opportunity to act (Sherraden, 2013). Following this framework, we define *behavioural capability* (*BC*) as enacted behaviours (budgeting, saving, investing, retirement planning) that indicate a person's practical engagement with financial management. *Perceived capability* (*PC*) reflects self-efficacy regarding the execution of these tasks and the perceived ability to maintain control over financial matters. Both *BC* and *PC* function as direct channels through which literacy affects wellbeing (Atkinson et al., 2007; Sabri et al., 2022).

A central proposition in capability research is that capability is distinct from financial resources. Individuals with high income may still show low capability, illustrating that capability concerns the effective use of available resources rather than the resources themselves (Taylor, 2011). Synthesis work describes financial capability as combining knowledge, behaviour, confidence, and access to financial opportunities (Shi et al., 2024). Within this structure, *PC*, capturing confidence, self-assessment, and perceived control, shows the strongest and most consistent association with subjective financial wellbeing. Bibliometric analyses confirm that *PC* is more closely linked to subjective outcomes than objective indicators of financial status (Singh & Malik, 2022).

Empirical evidence further reinforces the distinction between behavioural and perceptual elements. Sharma et al. (2024) find that financial self-efficacy is a recurrent and often stronger correlate of financial satisfaction than objective knowledge. Additional work shows that self-efficacy accounts for part of the association between literacy and financial wellbeing, supporting *PC* as a key mechanism linking *PFL* to *SFW* (Lone & Bhat, 2024).

Given this structure, we expect *BC* and *PC* to mediate the associations between literacy and both subjective and objective financial wellbeing. However, theory and prior evidence also indicate that literacy may retain direct links to wellbeing that do not operate through capability, so we allow for partial mediation in both the objective and perceived pathways. Thus,

H2. *After accounting for capability, OFL retains a direct association with OFW, and PFL retains a direct association with SFW (partial mediation).*

2.1.4. Non-Impulsive, Future-Oriented Behaviour

Non-impulsive, future-oriented behaviour (*NIB*) refers to a tendency to select delayed outcomes after considering alternatives, resist immediate rewards, and evaluate consequences using a future-time frame (Frigerio et al., 2020). Evidence indicates that numeracy, self-control, and affective reactions to numerical information shape financial management performance (Skagerlund et al., 2018). Because both self-control and future orientation are required to apply financial knowledge in practice, we treat *NIB* as a factor that may strengthen the association between *objective financial literacy* (*OFL*) and both *behavioural capability* (*BC*) and *objective financial wellbeing* (*OFW*). Empirical studies show that impulsive decision patterns correlate with high-risk debt, while future orientation strengthens the benefits of financial knowledge (Frigerio et al., 2020; Tahir et al., 2021). Specifically,

H3a. *NIB conditions the OFL→BC associations.*

H3b. *NIB conditions the OFL→OFW associations.*

2.1.5. Subjective and Objective Financial Wellbeing

Subjective financial wellbeing (*SFW*) refers to a person's assessment of their ability to meet current financial commitments, maintain security regarding future expenses, and exercise discretionary financial choice (Brüggen et al., 2017; Consumer Financial Protection Bureau, 2015). Research separates present-oriented wellbeing, commonly measured through current financial stress, from future-oriented wellbeing, assessed through expected future security. These components have different antecedents: trait self-control largely predicts current stress levels, while future-time perspective predicts perceived long-term security (van Raaij et al., 2023). Following the CFPB framework, we define SFW as perceived control, shock-absorption capacity, progress towards goals, and discretionary freedom. We treat *OFW* as observable indicators of security and resilience, such as accumulated assets and savings behaviour, conceptually related to but analytically distinct from *SFW*.

The ability to withstand unexpected financial shocks, treated here as a core element of *OFW*, functions as a pathway through which literacy is associated with wellbeing in financially vulnerable groups. Studying Greek university students after the financial crisis, Philippas and Avdoulas (2020) report that financial literacy predicts both general wellbeing and the capacity to cope with unplanned expenses. Their findings in a prolonged recessionary context support separating resilience from subjective satisfaction and position literacy as a precursor to measurable financial resilience.

Macroeconomic conditions constitute an additional structural constraint on objective financial wellbeing that operates independently of individual behaviour and capability. High and sustained inflation erodes the real value of savings, raises the cost of servicing debt, and compresses household purchasing power, limiting the extent to which prudent financial behaviour corresponds to tangible improvements in financial resilience (Pallotti et al., 2024). European evidence from the 2021–2023 inflationary episode shows that households across the euro area experienced sizable welfare losses as real wages fell and energy

and food costs rose sharply, with lower-income households disproportionately affected (Amores et al., 2023). This implies that the association between behavioural capability and objective financial wellbeing is not fixed but contingent on the broader macroeconomic regime: in adverse conditions, the link between competent financial behaviour and measurable resilience is attenuated by forces outside household control. Capability theory explicitly accommodates this mechanism by distinguishing individual ability to act from the structural opportunity to do so (Sherraden, 2013), and the 2023 wave of the Portuguese data offers a direct empirical window on this contingency.

2.2. Summary of Hypotheses and Conceptual Model

Objective financial literacy (*OFL*) is expected to increase *behavioural capability* (*BC*), and *BC* is expected to predict *objective financial wellbeing* (*OFW*). This forms the indirect H1a path, while allowing a residual direct *OFL–OFW* association consistent with the established evidence (Lusardi & Mitchell, 2011; Sherraden, 2013). *Perceived financial literacy* (*PFL*) is expected to increase *perceived capability* (*PC*), a self-efficacy-based assessment of one's ability to carry out financial tasks, which in turn should predict *subjective financial wellbeing* (*SFW*). This constitutes the indirect H1b path and allows a direct *PFL–SFW* link (Consumer Financial Protection Bureau, 2015). These two routes reflect that objective and perceived literacy correspond to different capability mechanisms and different wellbeing domains (Atkinson et al., 2007; Sabri et al., 2022).

NIB is expected to moderate the objective route. When individuals rely more heavily on future-time evaluation, the *OFL* → *BC* and *OFL* → *OFW* associations should increase, reflecting evidence that self-regulation affects whether knowledge is converted into behaviour and measurable outcomes (Frigerio et al., 2020; Tahir et al., 2021). These propositions form a moderated-mediation structure combining findings from literacy research, capability theory, and self-regulation psychology. Figure 1 presents the two-path model.

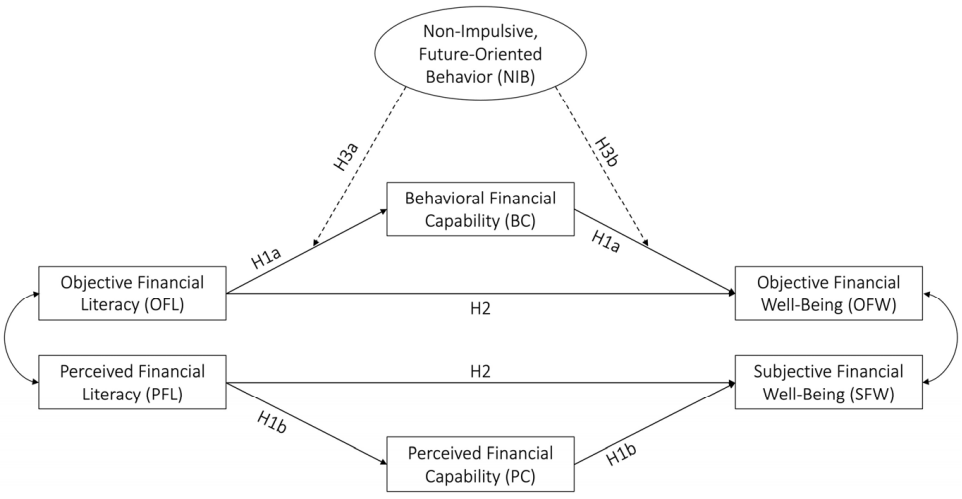

Figure 1. Conceptual model.

It should be noted that the pathways proposed here are theoretical associations informed by prior empirical work. Because this study relies on repeated cross-sectional data, the estimated associations do not constitute evidence of temporal or causal sequences between constructs.

In this structure, *OFL* links to *BC* and, via *BC*, to *OFW*, while *PFL* links to *PC* and, via *PC*, to *SFW*. *NIB* moderates the *OFL*-based path, and the model distinguishes subjective and objective wellbeing in line with contemporary definitions. Covariances between *OFL* and *PFL*, and between *OFW* and *SFW*, are specified to capture expected associations among

literacy indicators and wellbeing outcomes. The model provides a single representation of how literacy, capability, and self-regulatory tendencies contribute to financial wellbeing.

3. Methods

3.1. Research Design

The study applies a repeated cross-sectional design based on three independent survey waves (2015, 2020, 2023) using the National Council of Financial Supervisors (CNSF) questionnaire. The analysis therefore compares population-level patterns across waves rather than changes within individuals. The empirical tests assess a theory-specified, two-lane structural model that separates an objective lane (*OFL* → *BC* → *OFW*) from a perceived lane (*PFL* → *PC* → *SFW*).

Given evidence that self-regulatory tendencies are associated with whether financial knowledge is applied in practice, we examine moderation by *NIB* on the objective lane, testing whether *NIB* increases the *OFL* → *BC* and *OFL* → *OFW* associations (H3a–H3b). In line with capability-based accounts of financial functioning, we estimate indirect effects through *BC* and *PC* to assess whether these capability indicators act as proximal mechanisms linking literacy to wellbeing (H1a–H1b).

To ensure comparability across time, we first evaluate measurement invariance for the reflective constructs (*OFL* and *SFW*) using multi-group SEM (configural → metric → scalar, with partial invariance where warranted). Only after establishing acceptable cross-wave comparability do we examine cross-wave stability in the structural associations.

3.2. Instrument and Procedure

The CNSF survey provides the material needed to operationalise the model: standard objective literacy items, attitudinal and behavioural indicators, and financial outcome measures. Reflective constructs, estimated with categorical indicators under WLSMV in confirmatory factor analysis, are distinguished from formative or composite constructs, which are derived by standardising components within each wave and combining them on a common scale. This specification supports the multi-group invariance tests for the reflective blocks (*OFL* and *SFW*) described in Sections 3.3.4 and 4.2.

3.2.1. Reflective Constructs

- *Objective Financial Literacy (OFL)*—This is a reflective latent measured with six binary items: LF_div, LF_inf, LF_JS, LF_JC, LF_jur25, LF_Diver (1 = correct). Given the shared content of the interest rate items, we allow a correlated uniqueness between LF_JS and LF_JC across groups in CFA/SEM. Indicators are treated as categorical.
- *Subjective Financial Wellbeing (SFW)*—SFW is a reflective latent measured with three Likert items: satisfied, worry (reversed), and debt (reversed). Items capture satisfaction, perceived strain, and debt burden; responses are ordered and modelled as categorical (the control item is not part of *SFW*; see *PC* below).

3.2.2. Observed Single Indicator Constructs

- *Perceived Financial Literacy (PFL)*—LF_auto (recoded so higher = higher perceived literacy).
- *Perceived Capability (PC)*—control ("I keep a close personal watch on my financial affairs") is used as a single observed indicator. A multi-indicator *PC* factor (e.g., on_time, ability, risk_prepared) did not satisfy reflective assumptions (Heywood/very low loadings), so *PC* is operationalized as observed.

3.2.3. Observed Composite and Formative Constructs

- *Non-Impulsive, Future-Oriented Behaviour (NIB)*—Operationalized as an observed composite NIB_obs, computed as the within wave sum of z scores of impulsiveness (reversed in the dataset so higher = less impulsive) and ponder. We omit today and long_term from the measurement model due to unstable/weak loadings across waves.
- *Behavioural Capability (BC)*—Formative/composite index combining saving/investing actions (save_conta, save_dprazo, save_AOF) and retirement planning (HasPlan, PlanConf) using the split variable strategy: HasPlan = 1 for original categories 1–5, 0 for category 6, missing otherwise; PlanConf retains 1–5 among planners and is missing for non-planners. All components are z-standardised within wave and averaged; the composite requires $\geq$3 non-missing components.
- *Objective Financial Wellbeing (OFW)*—Formative/composite index integrating loss_inc (1–5 resilience; "don't know/no response" set missing), asset_count (tem_dp + tem_ca + tem_acc + tem_obr + tem_fi; 0–5), and save_not (reversed so higher = saving). Components are z-standardised within wave and averaged; the composite requires $\geq$2 non-missing components.

3.2.4. Coding and Missingness

Higher values on LF_auto, ability, impulse, today, save_not, debt, and worry were recoded to represent higher literacy, capability, or wellbeing, following the codebook and the theoretical direction of the constructs. Ordered responses were treated as categorical in the CFA/SEM analyses. "Don't know/no response" categories (e.g., Likert "6/7/8"; loss_inc = 6–7; income = 6–7) were coded as missing. For formative or composite indices, all components were z-standardised within each wave before aggregation to place them on a common scale. Table A1 in Separate Appendix A lists every questionnaire item, including those excluded from the final reflective models (e.g., today, long_term, LF_riskret, LF_over, LF_over_seg). The table notes the basis for exclusion, such as unstable or very low factor loadings or evidence of local misfit.

The surveys integrated the international comparison exercise of financial literacy levels promoted by the International Network on Financial Education (INFE) of the OECD. The surveys targeted the resident population of Portugal (including the Azores and Madeira islands) aged 16 years or older. In each wave, the sample was stratified to ensure representativeness across gender, age, geographic location, employment status, and education level. Face-to-face interviews were conducted. The random-route method was used to locate the interviewee (subject to the quotas defined for each stratum). We restrict the analysis to questions and variables that are identical in all three waves.

3.3. Data Analysis

Internal consistency and construct validity were examined before estimating the structural models. Convergent validity was assessed using composite reliability and average variance extracted following Fornell and Larcker (1981). Discriminant validity was evaluated by comparing the square roots of the AVEs with the inter-construct correlations, following standard SEM procedures (Hair et al., 2019). These checks indicated that OFL and SFW met the required reliability and validity thresholds for subsequent structural estimation.

All CFA and SEM models were fitted in R using *lavaan* 0.6-21(Rosseel, 2012). Because the reflective indicators were binary or ordinal, estimation used WLSMV with ordered variables declared explicitly, producing polychoric correlations and more accurate loadings for indicators with few response categories.

3.3.1. Reflective Measurement Models

The preregistered plan specified per-wave CFA estimation under WLSMV. OFL was specified as a six-indicator factor (LF_div, LF_inf, LF_JS, LF_JC, LF_jur25, LF_Diver). The residuals of LF_JS and LF_JC were correlated across waves due to shared interest-rate content. *SFW* was specified as a three-indicator factor (satisfied, worry [reversed], debt [reversed]), with all items treated as ordered categorical variables.

3.3.2. Observed Constructs

PFL was treated as a single observed indicator (LF_auto, reverse-scored so higher values indicate greater perceived literacy). *PC* was represented by the control item alone because attempts to specify a multi-indicator reflective factor (on_time, ability, risk_prepared) produced Heywood cases and near-zero loadings in all waves. Treating PC as a single observed indicator assumes zero measurement error for that variable. This assumption is acknowledged as a limitation; however, measurement error in a single-item mediator attenuates rather than inflates the estimated indirect path through it, meaning that the non-significant PC → SFW path and the absence of mediation via PC represent a conservative result rather than an artefact of overestimation. *NIB* was computed as an observed composite (NIB_obs), defined as the within-wave sum of the standardised impulse item (reverse-scored) and ponder. The items today and long_term were removed due to weak and unstable loadings across waves.

3.3.3. Formative/Composite Constructs

BC and *OFW* were specified as formative wave-standardised composites. *BC* combined saving and investing items (save_conta, save_dprazo, save_AOF) with retirement-planning indicators (HasPlan, PlanConf). Each component was z-standardised within wave and averaged when at least three non-missing indicators were available. *OFW* combined loss_inc, an asset count (tem_dp + tem_ca + tem_acc + tem_obr + tem_fi), and save_not_rev, again standardised within wave and computed when at least two indicators were present.

Reflective-type indices such as Cronbach's α, CR, and AVE are unsuitable for formative specifications because formative indicators need not covary or reflect a single latent tendency (Diamantopoulos & Winklhofer, 2001; Hair et al., 2019). Validation therefore focused on (a) theoretical justification for each indicator, (b) checks for overlap or redundancy, (c) consistency of within-wave standardisation, and (d) inspection of multicollinearity. *BC* and *OFW* were evaluated descriptively and within the structural model rather than through reflective psychometric criteria.

3.3.4. Measurement Invariance

Measurement invariance for *OFL* and *SFW* across 2015, 2020, and 2023 was examined using multi-group CFA with WLSMV estimation. Models were fitted sequentially (configural, metric, scalar). Invariance decisions were based on ΔCFI ≤ 0.010 and ΔRMSEA ≤ 0.015, with partial invariance introduced where modification indices or cross-wave strain identified local misfit. Invariance was required to ensure comparable latent meanings across waves before assessing temporal stability in structural paths.

3.3.5. Structural Modelling

Conditional on establishing comparability across waves, we estimated the two-lane structural model by wave and then in a multi-group SEM to assess cross-wave stability. The objective lane specified *OFL* → *BC* → *OFW* (H1a) with an additional *OFL* → *OFW* path (H2); the perceived lane specified *PFL* → *PC* → *SFW* (H1b) with an additional *PFL* → *SFW* path (H2). We modelled covariance between *OFL* and *PFL* and between *SFW*

and *OFW*, reflecting expected associations between the literacy variables and between the two wellbeing outcomes.

Cross-wave structural stability was assessed using Chow tests rather than a constrained multi-group SEM comparison. The Chow test compares wave-specific (unrestricted) parameter estimates against a pooled (restricted) solution for each structural equation, with the F-statistic testing the null hypothesis that all coefficients in the equation are equal across the three waves. This approach was adopted after a specification error was identified in the initial multi-group SEM run, in which path labels had been inadvertently carried into the configural model, pre-imposing equality and rendering the constrained-versus-configural comparison uninformative. The Chow test was therefore adopted as a deliberate methodological decision, not merely as a fallback: by estimating each structural equation independently against a genuinely unconstrained wave-specific baseline, it provides a cleaner and more interpretable test of cross-wave path equality than a multi-group SEM in which the configural baseline had been inadvertently constrained (Chow, 1960). Predictors were mean-centred within wave prior to pooled and wave-specific estimation to preserve comparability with the factor-score SEM models.

3.3.6. Moderation Analysis

NIB, treated as an observed composite, moderated the objective lane via interaction terms (OFL $\times$ NIB_obs) predicting *BC* and *OFW* (H3a–H3b). Predictors were mean-centred within wave. Post-estimation routines produced conditional effects for *NIB* at -1 SD, the mean, and +1 SD.

3.3.7. Inference and Missing Data

For categorical CFA/SEM we report χ^2, CFI, TLI, RMSEA, and SRMR. Indirect effects used delta-method standard errors because WLSMV in *lavaan* does not support non-parametric bootstrapping. Missing data in ordinal indicators were handled through WLSMV's pairwise estimation of polychoric correlations. Composite indices (*BC*, *OFW*) used person-mean scores with minimum-item requirements. Sensitivity checks added age and income as auxiliary variables to evaluate robustness under plausible missing-at-random conditions.

3.4. Sample

The dataset comprises three nationally representative cross-sections of adults in Portugal collected by the CNSF in 2015, 2020, and 2023. As the surveys lack longitudinal identifiers, the analysis uses independent samples rather than a panel. The merged dataset includes 3648 respondents. Appendix A (Table A1: Panels A–D) presents box-plots, distributions, and descriptive statistics for all sociodemographic, literacy, capability, and wellbeing measures.

Sample characteristics remain stable across waves, aside from demographic shifts consistent with national patterns. Mean age increases from 47.9 years in 2015 to 52.4 years in 2023, reflecting population ageing. Gender proportions remain near parity (approximately 52–53% women). The share of respondents with higher education rises from 16% to 21%, aligning with the expansion of tertiary qualifications.

Household income distributions move upward, with more respondents reporting mid- and upper-income categories in 2020 and 2023 than in 2015, although lower-middle incomes remain common. Activity status reflects labour-market conditions: the proportion in employment or self-employment increases from 48% to 57%, while unemployment falls from 9% to 4.5%. Marital status and regional distributions (Norte, Centro, Lisboa, Alentejo, Algarve, Madeira, Azores) remain close to national profiles. Town-size distributions remain comparable across waves, with a minor shift in 2023 stemming from revised CNSF coding.

Appendix A reports wave-specific descriptive statistics for the constructs used in the SEM models (*OFL*, *PFL*, *BC*, *PC*, *OFW*, *SFW*, *NIB*), based on cleaned and recoded indicators. Variations across waves are visible in objective financial knowledge, planning and saving practices, perceived capability, and resilience. Missing data were addressed using the procedures in Section 3.3 (pairwise estimation for categorical variables and person-mean rules for composite indicators).

Overall, the three samples match national sociodemographic and economic profiles for the respective years, supporting their comparability and the use of multi-group analyses. Table 1 reports unweighted sample sizes and core demographics for each wave (2015: 1028; 2020: 1229; 2023: 1391). As the CNSF does not supply survey weights, all descriptive and inferential analyses use unweighted observations, which is standard for repeated cross-sectional surveys of this type.

Table 1. Sample size and core demographic characteristics by survey wave (unweighted).

Characteristic	2015	2020	2023
Unweighted *N*	1028	1229	1391
Mean age (*SD*)	47.85 (18.34)	49.07 (18.21)	52.38 (18.70)
% Female	52.20%	51.90%	53.30%
% Higher education	16.20%	20.50%	21.40%
% Active (employed/self-employed)	47.70%	55.30%	57.40%
% Married	56.50%	60.90%	61.20%
Income category (mean, 1–5)	3.29	3.47	3.71
Largest region (NUTS II)	Norte (36.9%)	Norte (36.5%)	Norte (36.0%)
Town size: Small	48.50%	46.50%	47.70%

Note: *N* = Frequency; *SD* = Standard deviation.

4. Results

4.1. Measurement Models

We evaluated the reflective constructs (*OFL* and *SFW*) with per-wave CFA using WLSMV and ordered indicators for 2015, 2020, and 2023. The *OFL* factor was specified with six binary items (LF_div, LF_inf, LF_JS, LF_JC, LF_jur25, LF_Diver) and a correlated residual between LF_JS and LF_JC due to shared interest-rate content. Model fit was high in 2015 (CFI = 1.00, RMSEA = 0.00; SRMR = 0.031), good in 2020 (CFI = 0.978, RMSEA = 0.061; SRMR = 0.065), and within acceptable bounds in 2023 (CFI = 0.946, RMSEA = 0.091; SRMR = 0.095). Cross-wave variation in loadings reflected shifts in item difficulty, most evident for LF_inf and LF_Diver (Table 2). LF_div, LF_JS, and LF_jur25 were the most reliable indicators (standardised loadings typically >0.70), LF_JC showed intermediate loadings (0.45–0.58), and LF_inf and LF_Diver remained weaker but consistently associated with the construct despite year-specific variability (e.g., LF_Diver = 0.15 in 2015; LF_inf = 0.32 in 2023). Both items are part of the internationally standardised OECD/INFE battery and are retained on the grounds of content validity (the OFL construct is intended to capture knowledge of diversification and inflation as conceptually distinct domains) and cross-wave comparability; their wave-specific loading instability is accommodated by the partial metric invariance specification, which frees their loadings across waves rather than constraining them to equality.

SFW was modelled with three reflective indicators (satisfied, worry_rev, debt_rev). The model was just-identified. Standardised loadings were stable across waves (≈0.50–0.75). The satisfied item showed the smallest temporal variation, whereas worry_rev increased in 2023. The three indicators formed a coherent latent structure across all years.

Table 2. Standardised loadings.

Construct/Item	2015	2020	2023
Objective Financial Literacy			
LF_div	0.946	0.758	0.863
LF_inf	0.555	0.570	0.319
LF_JS	0.811	0.870	0.889
LF_JC	0.453	0.552	0.583
LF_jur25	0.653	0.743	0.539
LF_Diver	0.154	0.467	0.595
Subjective Financial Wellbeing			
satisfied	0.740	0.724	0.671
worry_rev	0.601	0.487	0.742
debt_rev	0.510	0.464	0.586

Table 3 reports reliability and validity metrics. For *OFL*, CR ranged from 0.80 to 0.83 (2015/2020/2023: 0.795/0.828/0.806) and AVE from 0.43 to 0.46 (0.428/0.456/0.444). For *SFW*, CR ranged from 0.57 to 0.71 (0.651/0.573/0.708) and AVE from 0.31 to 0.46 (0.392/0.314/0.457). AVE values below 0.50 are expected with binary or short ordinal scales, as polychoric correlations estimated from items with few response categories tend to be attenuated relative to Pearson correlations assumed by standard AVE formulas (Rhemtulla et al., 2012; Sijtsma, 2009). Convergent validity was supported by the combination of CR estimates, statistically substantive loadings, and acceptable CFA fit. The below-threshold AVE (0.314) and CR (0.573) for SFW in 2020 are acknowledged as a limitation of the survey instrument in that wave; they imply that estimates involving the 2020 SFW factor score should be interpreted with additional caution, as discussed in Section 6.4. Cronbach's α was reported for completeness, but interpretation relied on model-based CR and AVE due to α's assumptions regarding tau-equivalence and continuous measurement.

Table 3. Reliability, convergent and discriminant validity of reflective constructs by wave.

Construct	Correlations		Cronbach's α	CR	AVE
	2015				
OFL	**0.654**		0.549	0.795	0.428
SFW	0.337 ***	**0.626**	0.605	0.428	0.392
	2020				
OFL	**0.675**		0.641	0.828	0.456
SFW	0.243 ***	**0.561**	0.508	0.573	0.314
	2023				
OFL	**0.666**		0.592	0.806	0.444
SFW	0.379 ***	**0.676**	0.646	0.708	0.457

Notes: *** $p < 0.001$, two-tailed. CR = Composite reliability; AVE = Average variance extracted; Diagonal entries in bold represent the square root of the AVE.

Discriminant validity between *OFL* and *SFW* was assessed using the Fornell–Larcker criterion. In each wave, the square root of AVE for both constructs exceeded the absolute latent *OFL–SFW* correlation, and the *OFL–SFW* correlation remained below $\sqrt{\text{AVE}}$, indicating adequate separation between the constructs.

As outlined in Section 3.3, *PFL* (LF_auto) and *PC* (control) were treated as single observed indicators; *NIB* was computed as NIB_obs = z(impulse) + z(ponder) within wave; and *BC* and *OFW* were specified as wave-standardised formative composites. These variables were therefore not evaluated using CR, AVE, or Fornell–Larcker criteria.

4.2. Measurement Invariance

We assessed cross-wave measurement invariance for *OFL* and *SFW* using multi-group CFA with WLSMV for ordered indicators. Invariance was tested sequentially (configural, metric, scalar) using ΔCFI ≤ 0.010 and ΔRMSEA ≤ 0.015 as decision criteria.

For *OFL*, the configural model showed acceptable fit (CFI = 0.971, RMSEA = 0.066) (see Table 4). Constraining loadings reduced CFI beyond the threshold (ΔCFI = -0.034), so full metric invariance was rejected. Item-level diagnostics indicated that LF_inf and LF_Diver produced the misfit. Freeing their loadings yielded a partial metric model with improved fit (CFI = 0.966, RMSEA = 0.062; ΔCFI = -0.0048, ΔRMSEA = -0.0042). Adding threshold constraints was feasible once the binary thresholds for the same two items were freed; this partial scalar model also met invariance criteria (CFI = 0.966, RMSEA = 0.067).

For SFW, the configural model fitted well (CFI = 1.000, RMSEA = 0.000). Metric invariance held on the basis of ΔCFI (-0.003), despite a small RMSEA increase, which is expected for short ordinal scales. Full scalar invariance failed (ΔCFI = -0.017). Releasing all thresholds for debt and worry produced an acceptable partial scalar model (CFI = 0.999, RMSEA = 0.000; ΔCFI = +0.0022, ΔRMSEA = -0.0356).

Both constructs therefore met metric (or partial-metric) and partial-scalar requirements, allowing cross-wave comparison in the structural SEM. Minor warnings regarding parameter covariances reflect numerical sensitivity in WLSMV threshold estimation and do not affect identification or interpretation.

Table 4. Measurement invariance for *OFL* and *SFW* across waves (2015–2020–2023).

Construct	Model	CFI	RMSEA	TLI	SRMR	ΔCFI	ΔRMSEA
OFL (6 items; LF_JS~~LF_JC)	Configural	0.971	0.066	0.946	0.067	—	—
	Partial Metric	0.966	0.062	0.953	0.075	−0.0048	−0.0042
	Partial Scalar	0.966	0.067	0.945	0.075	−0.0009	+0.0051
SFW (3 items)	Configural	1.000	0.000	1.000	0.000	—	—
	Metric	0.997	0.036	0.994	0.021	−0.0030	+0.0360
	Partial Scalar	0.999	0.000	1.000	0.000	+0.0022	−0.0356

Notes: *OFL* partial metric invariance frees loadings for LF_inf and LF_Diver; *OFL* partial scalar additionally frees binary thresholds for LF_inf and LF_Diver. SFW partial scalar frees thresholds (t1–t4) for debt and worry. ΔCFI and ΔRMSEA are computed relative to the previous step (metric vs. configural; scalar vs. metric). All models were estimated with WLSMV treating indicators as ordered.

4.3. Structural SEM

The structural results were estimated with a two-step SEM procedure. Per-wave CFAs using WLSMV with ordered indicators produced Bartlett factor scores for *OFL* and *SFW* that, together with the observed composites (*BC*, *OFW*) and observed variables (*PFL*, *PC*, *NIB*), were then used in per-wave structural models estimated with MLR. Moderation in the objective lane (*OFL* $\times$ *NIB*) and cross-wave stability for 2015, 2020, and 2023 were examined (Tables 5–8).

Table 5. Per-wave structural model fit (factor-score SEM).

Wave	CFI	TLI	RMSEA	SRMR
2015	0.344	−0.313	0.181	0.111
2020	0.542	0.084	0.148	0.091
2023	0.450	−0.100	0.199	0.111

Notes: Fit indices refer to the per-wave structural models estimated in the two-step SEM: Bartlett factor scores for *OFL* and *SFW* were first obtained from per-wave WLSMV CFAs with ordered indicators; structural paths were then estimated with MLR using observed variables (OFL_fs, SFW_fs, *BC*, *OFW*, *PFL*, *PC*, *NIB*). Values shown are CFI, TLI, RMSEA, and SRMR for the structural (factor-score) models; measurement-model fit is reported in Section 4.1. All predictors were centred within wave to preserve comparability across years.

Table 6. Key standardised path coefficients and indirect paths (per wave).

Wave	Path	Std. Coefficient β	*p*
2015	a1: OFL_fs → *BC*	0.132	<0.001
2015	a2: *NIB* → *BC*	0.143	<0.001
2015	b1: *BC* → *OFW*	0.190	<0.001
2015	c1: OFL_fs → *OFW*	0.071	0.022
2015	b2: *NIB* → *OFW*	0.012	0.660
2015	d1: *PFL* → *PC*	0.138	<0.001
2015	e1: *PC* → SFW_fs	0.008	0.792
2015	e2: *PFL* → SFW_fs	0.226	<0.001
2015	ind_OFW_via_*BC*	0.025	0.002
2015	ind_SFW_via_*PC*	0.001	0.792
2020	a1: OFL_fs → *BC*	0.205	<0.001
2020	a2: *NIB* → *BC*	0.059	0.048
2020	b1: *BC* → *OFW*	0.201	<0.001
2020	c1: OFL_fs → *OFW*	0.149	<0.001
2020	b2: *NIB* → *OFW*	−0.010	0.696
2020	d1: *PFL* → *PC*	0.226	<0.001
2020	e1: *PC* → SFW_fs	0.015	0.663
2020	e2: *PFL* → SFW_fs	0.220	<0.001
2020	ind_OFW_via_BC	0.041	<0.001
2020	ind_SFW_via_PC	0.003	0.663
2023	a1: OFL_fs → *BC*	0.209	<0.001
2023	a2: *NIB* → *BC*	−0.214	<0.001
2023	b1: *BC* → *OFW*	0.031	0.261
2023	c1: OFL_fs → *OFW*	0.243	<0.001
2023	b2: *NIB* → *OFW*	0.169	<0.001
2023	d1: *PFL* → *PC*	−0.004	0.879
2023	e1: *PC* → SFW_fs	0.046	0.131
2023	e2: *PFL* → SFW_fs	0.220	<0.001
2023	ind_OFW_via_*BC*	0.006	0.278
2023	ind_SFW_via_*PC*	0.000	0.878

Notes: Standardised coefficients are from per-wave structural models estimated using the two-step SEM approach: Bartlett factor scores for *OFL* and *SFW* were obtained from per-wave WLSMV CFA models, and the structural paths were then estimated with MLR using observed composites (*BC*, *OFW*) and centred observed predictors (PFL_c, PC_c, NIB_c). Paths labelled a1–c1 refer to the objective lane (*OFL* → *BC* → *OFW*); paths d1–e2 refer to the perceived lane (*PFL* → *PC* → *SFW*). Indirect effects (ind_OFW_via_BC and ind_SFW_via_PC) use delta-method standard errors. All predictors (factor scores and composites) were centred within wave to preserve comparability across years. Two-tailed *p*-values are reported.

Table 7. Moderation (OFL_fs × NIB): Coefficients per wave.

Wave	a3 (*OFL* × *NIB* → *BC*)	*p*	c3 (*OFL* × *NIB* → *OFW*)	*p*
2015	−0.018	0.598	0.082	0.007
2020	−0.013	0.610	−0.016	0.587
2023	0.018	0.616	0.092	0.005

Notes: Coefficients are standardised estimates from per-wave factor-score structural models (two-step SEM). OFL_fs denotes the Bartlett factor score for *OFL* obtained from per-wave WLSMV CFAs; *SFW* is modelled via an *SFW* factor score in the main path models, but the moderation table reports only the objective lane effects. *NIB* is the within-wave centred composite (z(impulse) + z(ponder)); OFL_fs is within-wave centred; the interaction term is OFL_fs × *NIB*. Structural paths were estimated with MLR (robust ML) using observed factor scores and composites. Entries show the interaction on *BC* (a3: OFL_fs × *NIB* → *BC*) and on *OFW* (c3: OFL_fs × *NIB* → *OFW*) alongside main effects (reported for context in the narrative/tables). Two-tailed *p*-values are shown; conventional thresholds were used ($p < 0.05$, $p < 0.01$, $p < 0.001$). A positive c3 indicates that the *OFL* → *OFW* association is stronger at higher *NIB* in that wave; a non-significant a3 indicates no robust moderation on *OFL* → *BC*. All covariates and outcomes are measured within wave to preserve comparability with the invariance-supported measurement stage.

Table 8. Cross-wave structural stability: Chow test results.

Path	*F*	*df*1	*df*2	*p*	Decision
OFL → BC (a1)	14.27	6	3639	<0.001	Paths vary across waves
BC → OFW (b1)	13.38	8	3636	<0.001	Paths vary across waves
OFL → OFW (c1)	13.38	8	3636	<0.001	Paths vary across waves
PFL → PC (d1)	10.61	4	3642	<0.001	Paths vary across waves
PC → SFW (e1)	2.51	6	3639	0.02	Paths vary across waves
PFL → SFW (e2)	2.51	6	3639	0.02	Paths vary across waves

Notes: Chow tests compare wave-specific (unrestricted) parameter estimates against a pooled (restricted) solution for each structural equation. F-statistics follow an $F(df1, df2)$ distribution under the null hypothesis of equal coefficients across waves. $df1 = (G - 1) \times$ k where $G = 3$ waves and k = number of parameters in the equation (including intercept); $df2$ = *total N minus* $G \times k$. *A significant* F indicates that at least one regression coefficient in that equation differs across waves. Results are based on factor-score path models using Bartlett factor scores for *OFL* and *SFW* obtained from per-wave WLSMV CFAs; structural paths estimated with MLR on observed variables. The objective-lane equations (a1, b1, c1) share the same *F* and degrees of freedom because they derive from the same outcome equation (*OFW*). Two-tailed *p*-values reported.

4.3.1. Model Fit and Nature of the Estimation Approach

The approach used here is a two-step factor-score regression, not a comprehensive structural equation model in the conventional sense. In the first step, per-wave WLSMV CFAs estimated with ordered indicators produce Bartlett factor scores for OFL and SFW. In the second step, these factor scores—together with the observed composites (BC, OFW) and single-item indicators (PFL, PC, NIB)—are entered as observed variables into wave-specific MLR structural models. The global fit indices in Table 5 (CFI 0.34–0.54; RMSEA 0.148–0.199) refer to this second-stage model only and should be interpreted in that context. These values fall below conventional thresholds, but this is expected and does not invalidate the structural estimates for the reasons set out below.

First, the indices refer only to the structural relations among factor scores and composites. The measurement models for OFL and SFW, reported in Section 4.1, showed adequate fit in all waves (CFI 0.946–1.00; RMSEA 0.00–0.091). The indicators therefore capture the intended constructs, and the lower fit values originate in the structural component, not in indicator misspecification.

Second, the structural model contains only theory-specified paths. No post hoc correlations or residual adjustments were introduced. This produces a sparse model in which several variables, particularly formative composites and single-item constructs, are not expected to covary beyond the hypothesised paths. Such specifications typically generate low global fit, but they retain interpretive clarity.

Third, standard fit statistics are not well-defined for models containing formative composites. Fit indices such as CFI, TLI, and RMSEA were developed for reflective structures. Formative indicators place no constraints on their covariance, which makes the null model (the basis for these indices) conceptually weak (Kline, 2015). Negative TLI values are a known consequence when composites restrict the variance–covariance structure (Rigdon, 1998).

Fourth, inference relies on the estimated paths rather than global indices. When measurement models are correctly specified, the two-step approach yields unbiased regression estimates (Croon, 2014; Devlieger et al., 2016). Factor-score regression also provides consistent estimates with appropriate standard errors even when overall model reproduction is imperfect (Skrondal & Laake, 2001). Hypotheses H1–H3 were therefore assessed on the basis of coefficient magnitude, direction, and precision.

Fifth, cross-wave stability was assessed using Chow tests (Section 4.3.4), which confirmed significant path variation across waves, consistent with the wave-specific patterns discussed below.

Overall, the low fit indices reflect the sparse, theory-driven structural specification and the mixed measurement structure rather than substantive misspecification. The measurement models for OFL and SFW, estimated in the first step under WLSMV, showed adequate fit in all waves (CFI 0.946–1.00; RMSEA 0.00–0.091). The indicators capture the intended constructs, and the poor second-stage fit originates in the structural specification, not in indicator misspecification. Inference therefore relies on the magnitude, direction, and precision of the individual path estimates.

To assess whether the main conclusions depend on the exclusion of sociodemographic variables, key structural paths were re-estimated with age and income added as covariates in each wave. The substantive findings were unchanged: the OFL → BC association remained positive and significant across all waves; the BC → OFW path remained significant in 2015 and 2020 and non-significant in 2023; and the PFL → SFW direct association remained stable and significant in all waves. The inclusion of covariates did not alter the direction or significance of any of the key paths, supporting the robustness of the main conclusions to sociodemographic confounding.

The Chow test framework (Section 4.3.4, Table 8) estimates each structural equation independently per wave against a pooled solution, constituting a form of separate-equation modelling. The Chow test results, confirming significant cross-wave variation in all equations, are consistent with the per-wave SEM findings and provide an independent validation of the wave-specific pattern of associations, demonstrating that the main conclusions do not depend on a single estimation strategy.

4.3.2. Per-Wave Structural Models (Two-Lane)

Across all waves, *OFL* had a positive association with *BC* (standardised a1: 2015 = 0.13, 2020 = 0.21, 2023 = 0.21; all $p < 0.001$; see Table 6). The path from *BC* to *OFW* was significant in 2015–2020 (b1: 0.19 and 0.20; $p < 0.001$) but attenuated in 2023 (b1: 0.03; $p = 0.261$). The *OFL–OFW* association remained positive and statistically significant in all waves (c1: 0.07, 0.15, 0.24; all $p \leq 0.022$). Consequently, the indirect effect *OFL* → *OFW* via *BC* was significant in 2015 and 2020 (std. ≈ 0.03–0.04; $p \leq 0.002$) but not in 2023 (≈0.01; $p = 0.278$).

PFL was positively associated with *PC* in 2015–2020 (d1 ≈ 0.14/0.23; $p < 0.001$), but not in 2023 (d1 ≈ −0.00; $p = 0.879$). The *PC–SFW* association was not statistically significant in any wave (e1 ≈ 0.01–0.08; $p \geq 0.131$), whereas the *PFL–SFW* association was positive and statistically significant across waves (e2 ≈ 0.22–0.25; $p < 0.001$). The indirect association from *PFL* to *SFW* via *PC* was not statistically significant (see Table 6).

4.3.3. Moderation by Non-Impulsive Behaviour (Objective Lane)

We introduced the observed interaction between the *OFL* factor score and *NIB* (*OFL* × *NIB*) in the objective lane. The *OFL* × *NIB* interaction indicates that the *OFL–OFW* association was stronger at higher levels of *NIB* in 2015 and 2023 (c3 ≈ 0.08–0.09; $p \leq 0.007$), but not in 2020 (≈−0.02; $p = 0.587$). The interaction on the *OFL–BC* association (a3) was not statistically significant in any wave. These results suggest that the *OFL* → *OFW* association strengthens at higher *NIB* in 2015 and 2023 (see Table 7).

4.3.4. Tests of Structural Path Equality Across Survey Waves

To test whether structural paths are stable across waves, we compared a constrained model (all regression paths equal across 2015, 2020, and 2023) against a freely estimated configural baseline. In the initial multi-group SEM run, fit indices were identical across the two models (ΔCFI = 0, ΔRMSEA = 0), which indicated a specification error: path labels had been inadvertently carried into the configural model, effectively pre-imposing equality and rendering the comparison uninformative.

To obtain a genuine test of cross-wave stability, we implemented Chow tests on each structural equation, comparing wave-specific (unrestricted) parameter estimates against a pooled (restricted) solution. This approach provides a valid free-baseline test without relying on the multi-group SEM labelling. The Chow tests indicate significant cross-wave variation in all structural equations (Table 8). Rather than undermining the analysis, this result directly supports the paper's central argument: the BC → OFW pathway weakens in 2023, the PFL → PC association disappears in 2023, and the NIB moderation of the OFL → OFW path is absent in 2020. These are genuine cross-wave differences, and the Chow tests confirm their statistical reality. The pattern of per-wave coefficients in Table 6, not a constrained multi-group solution, is therefore the appropriate basis for inference. Cross-wave stability in the perceived lane (e1, e2) is weaker than in the objective lane, consistent with the lower F-statistic for those equations.

5. Discussion

The findings provide partial support for the dual-lane model. The objective lane—linking OFL to OFW through BC—held in 2015 and 2020 but not in 2023, when the BC → OFW path attenuated to non-significance. The perceived lane, linking PFL to SFW through PC, did not hold in any wave: perceived capability did not mediate the PFL → SFW association, and PFL operated directly on SFW throughout. NIB moderated the objective lane in 2015 and 2023 but not in 2020. These asymmetries are not peripheral qualifications; they are the substantive findings of the study.

5.1. The Attenuation of BC → OFW in 2023—Macroeconomic Contingency

Across all waves, objective financial literacy was positively associated with behavioural capability. Higher literacy test scores corresponded to observable behaviours such as maintaining savings, contributing to investment products, and preparing for retirement. This pattern remained stable despite declines in average literacy between 2015 and 2023 and is consistent with evidence that literacy predicts measurable financial behaviour (Cupák et al., 2019; Lusardi & Mitchell, 2011).

The *BC → OFW* pathway did not show the same stability. In 2015 and 2020, behavioural capability predicted stronger financial resilience, supporting research linking routine budgeting, saving, and planning to improved liquidity and reduced vulnerability (Sabri et al., 2022). By 2023, this relationship weakened and no longer met conventional significance thresholds.

The 2023 observations were collected during a period of high inflation, stagnant wages, and greater economic volatility in Portugal and Europe. Under these conditions, households may adopt prudent financial practices yet remain exposed to erosion of purchasing power or unanticipated shocks. These constraints limit the degree to which behavioural capability corresponds to improvements in objective financial conditions. This pattern aligns with findings that adverse macroeconomic environments weaken the link between behaviour and outcomes (Lusardi & Mitchell, 2011; Philippas & Avdoulas, 2020) and with capability theory, which emphasises that individual ability must coincide with structural opportunity (Sherraden, 2013).

The divergence across waves indicates the need to analyse financial wellbeing mechanisms under varying economic conditions. Evidence drawn from stable periods may overestimate the effectiveness of behavioural interventions, whereas evidence from periods of instability may underestimate the contribution of financial literacy. The results suggest that policies aimed at strengthening behavioural capability should be paired with structural measures during downturns, including temporary debt relief, emergency

savings supports, or inflation-indexed benefits. Behaviour alone cannot offset sustained macroeconomic pressure.

5.2. The Non-Mediation via PC—Confidence Acts Directly

The perceived-literacy pathway diverged from the expected mediation structure. Perceived financial literacy remained a stable predictor of subjective financial wellbeing across all waves ($\beta \approx 0.22$–0.25), replicating patterns reported by Singh and Malik (2022) and Fan and Henager (2022). Respondents reporting higher knowledge also reported greater perceived security, reduced financial stress, and higher satisfaction, consistent with accounts of perceived behavioural control and self-efficacy in financial contexts (van Raaij et al., 2023).

Perceived control (PC) did not mediate the *PFL–SFW* association. Although the model specified perceived capability as the mechanism through which perceived financial literacy would influence subjective financial wellbeing, perceived financial literacy operated directly in every wave. Two explanations are plausible. The single-item perceived capability indicator, adopted because multi-item variants failed the assumptions for reflective measurement, likely captured less variance than a latent construct, which would weaken the $PC \rightarrow SFW$ link. In addition, the perceived financial literacy measure appears to embed much of the cognitive appraisal that perceived capability was intended to capture. Self-ratings of financial knowledge naturally incorporate assessments of capability, meaning that perceived financial literacy items may already probe the same evaluative process as perceived capability. If so, the two function as overlapping indicators of a confidence-based construct rather than sequential components in a mediation chain.

This interpretation aligns with findings showing that perceived capability often serves as a proximal predictor of satisfaction and control, and that subjective literacy frequently outperforms objective tests because it captures confidence-related variance (Lone & Bhat, 2024; Sharma et al., 2024). The direct $PFL \rightarrow SFW$ association may therefore reflect the complete effect of this mechanism, leaving little variance for perceived capability to explain once perceived financial literacy is included.

For practitioners, these results indicate that interventions aiming to improve subjective wellbeing should strengthen confidence directly through structured practice, specific feedback, and accessible information, rather than assuming that increases in objective knowledge will automatically enhance perceived capability. Financial education that improves perceived competence may produce larger gains in wellbeing than instruction limited to conceptual accuracy. These recommendations apply as complements to, not substitutes for, objective financial education: the literature documents that uncalibrated confidence without adequate knowledge is itself a risk factor, associated with excessive risk-taking and poor debt management (Lusardi & Mitchell, 2011; Saeedi & Nishad, 2024), and interventions that raise perceived competence are therefore most effective when grounded in accurate financial knowledge. For research, the findings highlight the need for measurement strategies capable of distinguishing subjective literacy from perceived capability and theoretical models that specify their separate roles.

5.3. Wave-Specific Moderation by NIB—Context Matters

A distinct pattern emerged for non-impulsive, future-oriented behaviour. In 2015 and 2023, *NIB* increased the extent to which *OFL* predicted *OFW*, whereas no such effect appeared in 2020. This aligns with evidence that self-control and future orientation strengthen the returns of literacy (Frigerio et al., 2020; Tahir et al., 2021), but the temporal variation qualifies this relationship.

Higher levels of non-impulsive, future-oriented behaviour appear to facilitate the translation of literacy into measurable financial conditions. The interaction terms in 2015 and 2023 indicate that individuals with stronger self-regulatory traits show stronger associations between knowledge and objective outcomes, even though these traits do not alter the link between literacy and reported behaviour (the $OFL \rightarrow BC$ interaction was non-significant in all waves). Self-regulation therefore seems to function after behaviours are established: it supports persistence, adjustment to setbacks, and protection of accumulated resources.

The absence of moderation in 2020 points to constraints external to individual psychology. Data collection occurred immediately before Portugal's first COVID-19 lockdown. Income interruptions, employment suspensions, and market instability restricted the extent to which personal discipline could influence outcomes. Under such circumstances, the pathway from literacy to outcomes was limited by factors outside individual control.

These patterns imply that the moderating role of self-regulation depends on macroeconomic conditions. In periods of relative stability or recovery (2015, 2023), behavioural traits are associated with how effectively literacy predicts favourable outcomes. During acute disruption (early 2020), structural factors dominate, reducing the relevance of psychological differences. Policy measures aimed at supporting self-regulation, such as commitment mechanisms, default saving arrangements, or cooling-off periods, are therefore more likely to be effective in stable contexts, whereas crisis periods require direct financial interventions, including income support and temporary payment relief.

6. Conclusions

6.1. Key Findings

This study examined how objective and perceived financial literacy relate to financial wellbeing through two capability pathways, using three cross-sections. The results offer partial support for the dual-lane model: one of the two hypothesised mediation pathways—perceived capability as a mediator of PFL $\rightarrow$ SFW—did not hold in any wave, and the behavioural capability pathway to objective wellbeing attenuated in the most recent wave. The confirmed and disconfirmed paths are summarised below.

First, objective financial literacy consistently predicts behavioural capability. Demonstrated knowledge correlates with enacted money-management behaviours (saving, investing, retirement planning) across all three waves, even as population-level objective knowledge declined.

Second, behavioural capability correlates positively with objective financial wellbeing in 2015 and 2020, but this association weakens in 2023. Rising inflation and economic volatility appear to attenuate the translation of financial behaviour into tangible resilience. The behaviour-to-outcome link is therefore contingent on macroeconomic conditions, not stable.

Third, objective literacy maintains a direct association with objective wellbeing in all waves, indicating a knowledge-to-outcome channel not fully mediated by behaviour. Numeracy and task-specific knowledge may help households navigate complex products or economic shocks without extensive behavioural change.

Fourth, perceived financial literacy strongly predicts subjective financial wellbeing across all waves, but the expected mediation through perceived capability does not occur. Self-assessed knowledge acts directly on perceived security and financial satisfaction. Subjective literacy and perceived capability may therefore reflect the same confidence construct rather than distinct causal steps.

Fifth, non-impulsive, future-oriented tendencies strengthen the literacy-to-outcome association in the objective pathway in 2015 and 2023, but not in 2020. Self-regulation thus shapes the conditions under which knowledge predicts financial resilience, though this moderating effect disappears during pandemic-related disruption.

6.2. Theoretical Contributions

The findings refine contemporary capability-based models of financial functioning in four ways. First, they establish "knowledge-to-behaviour" and "confidence-to-perception" as asymmetrical pathways, not parallel ones. The objective pathway depends on enacted behaviour and macro context; the perceived pathway acts more directly on subjective outcomes. This asymmetry undermines simpler models positing symmetrical mediation and requires differentiated theoretical accounts.

Second, behavioural capability can be sufficient but not necessary for improvements in objective wellbeing. Knowledge maintains a direct, consistent association with resilience, indicating two mechanisms: an instrumental channel (through behavioural capability) and an informational channel (direct cognitive application). Literacy therefore acts both as a resource enabling action and as a cognitive tool households draw upon directly in financial decisions.

Third, self-regulation clarifies that non-impulsive, future-oriented tendencies do not meaningfully alter the conversion of knowledge into behaviour, but they do condition the conversion of knowledge into objective outcomes. Self-regulation operates as an "outcome-side amplifier" rather than a "behaviour-side catalyst," a distinction that matters for theory and intervention design. This moderating effect is itself temporally contingent: structural forces can override psychological mechanisms during crises.

Fourth, the results show temporal contingency as a critical dimension in financial capability research. Pathways that hold under stable conditions may attenuate when households face broader constraints. Capability is enabled or limited by context even when knowledge and intentions are present, which situates individual-level models within their macro-economic and institutional environments (Panos & Wilson, 2020).

6.3. Practical Implications

For educators and programme designers, the dual-path structure differentiates intervention levers. Programmes aimed at objective outcomes need to combine conceptual and numerical knowledge with behavioural discipline but should also include mechanisms such as emergency saving protocols for high-inflation periods. The translation of behaviour into outcomes erodes under adverse conditions.

For consumer-facing organisations, the perceived pathway requires tools that build financial confidence without overstatement: plain-language disclosures, just-in-time guidance, and feedback that increases perceived control. Perceived literacy correlates directly with subjective wellbeing. Interventions that raise self-perceived competence may improve wellbeing even when objective literacy does not measurably change. This recommendation should not be interpreted as endorsing confidence as a substitute for knowledge: overconfidence in the absence of objective financial literacy is associated with harmful financial behaviours, and confidence-building interventions are most beneficial when paired with content that improves the accuracy of self-assessments (Lusardi & Mitchell, 2011; Saeedi & Nishad, 2024).

Self-regulation moderates the literacy–resilience link, which suggests that regulators and product designers should support commitment devices and default structures. In volatile contexts, nudges that stabilise outcomes (automated sweeps into emergency buffers, for example) may be as effective as traditional education. The moderation effect depends on context: stable and crisis periods warrant different policy tools.

For national financial strategies, temporal divergence in the behaviour–outcome link means measurement dashboards should track not only knowledge and behaviour but also conversion effectiveness across macro regimes. When the behaviour-to-outcome link weakens, policy should shift towards structural supports, such as income protection, debt

forbearance, and social safety nets, rather than doubling down on behavioural interventions that lose traction in adverse environments.

6.4. Limitations

Several constraints limit the interpretation. First, the repeated cross-sectional design prevents tracking individuals over time; reported pathways are associational, not causal. Second, perceived capability was measured with a single indicator after multi-item scales failed reflective tests. Single indicators risk understating mediational effects, though the choice is theoretically defensible. Third, key behavioural and objective indices were modelled as formative composites. This precludes standard reliability statistics and prioritises content validity and construction rules over comparability with reflective constructs. PLS-SEM (Partial Least Squares SEM) would be an alternative better suited to models mixing formative and reflective constructs; however, PLS-SEM does not support ordinal WLSMV estimation, which was essential for the binary and Likert indicators in OFL and SFW. The two-step CB-SEM approach was therefore preferred to preserve measurement model fidelity for these constructs. Fourth, data come from national samples in one country across three periods; findings do not necessarily extend to other institutional settings or shock profiles. The results therefore describe patterned associations and their temporal stability, not causal effects obtainable from experimental or longitudinal designs. Finally, cross-wave structural stability was assessed using Chow tests rather than a formal multi-group SEM comparison, following the detection of a specification error in the initial multi-group run. Chow tests provide a valid test of path equality across equations but do not decompose variation at the level of individual coefficients within an equation, nor do they account for the factor-score measurement error that the two-step SEM procedure introduces. Future work with larger samples could estimate a fully identified multi-group SEM with genuinely unconstrained baselines to provide more granular tests of which specific paths drive cross-wave heterogeneity.

6.5. Future Research

Future work can address these limitations. Longitudinal household panels would test whether the $BC \rightarrow OFW$ attenuation arises from macro constraints or life-cycle effects, supporting stronger causal inference. Validated multi-indicator scales for perceived capability could establish whether the absent PC mediation reflects measurement or substance; experimental designs separating objective knowledge from confidence would further disentangle the two. Explicit tests of "conversion effectiveness" across macro environments (modelling inflation, unemployment, or interest rates as moderators) could identify policy-sensitive bottlenecks. Incorporating product architecture (defaults, fees, friction) would show how institutional design interacts with individual capability, linking capability theory to behavioural economics. Although demographics were excluded for conceptual clarity, heterogeneity analyses by income, education, and age may reveal segment-specific path differences relevant to financial inclusion. Cross-national comparisons, including variation in consumer protections, safety nets, and financial education infrastructure, would assess the dual-lane framework's portability. Replication outside Portugal is needed to test generalisability.

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Appendix A

Table A1. Descriptive statistics by survey wave.

Panel A. Sociodemographic characteristics				
Variable	**Wave**	**Mean (*SD*)**	**Min–Max**	***N***
Age (years)	2015	47.85 (18.34)	16–91	1028
	2020	49.07 (18.21)	16–93	1229
	2023	52.38 (18.70)	16–95	1391
Household income (1 lower income—5 higher income)	2015	3.29 (0.89)	1–5	832
	2020	3.47 (0.96)	1–5	1140
	2023	3.71 (0.84)	1–5	1313
	***n* (%)**	***n* (%)**	***n* (%)**	
Gender	**2015**	**2020**	**2023**	
Male	491 (47.8%)	591 (48.1%)	650 (46.7%)	
Female	537 (52.2%)	638 (51.9%)	741 (53.3%)	
Education	**2015**	**2020**	**2023**	
Basic/Secondary	861 (83.8%)	977 (79.5%)	1094 (78.6%)	
Higher education	167 (16.2%)	252 (20.5%)	297 (21.4%)	
Activity status	**2015**	**2020**	**2023**	
Active	490 (47.7%)	680 (55.3%)	798 (57.4%)	
Inactive	443 (43.1%)	456 (37.1%)	531 (38.2%)	
Unemployed	95 (9.2%)	93 (7.6%)	62 (4.5%)	
Marital status	**2015**	**2020**	**2023**	
Not married	447 (43.5%)	480 (39.1%)	540 (38.8%)	
Married	581 (56.5%)	749 (60.9%)	851 (61.2%)	
Region (NUTS II)	**2015**	**2020**	**2023**	
Norte	379 (36.9%)	448 (36.5%)	501 (36.0%)	
Centro	243 (23.6%)	280 (22.8%)	313 (22.5%)	
Lisboa	262 (25.5%)	319 (26.0%)	365 (26.2%)	
Alentejo	63 (6.1%)	72 (5.9%)	92 (6.6%)	
Algarve	45 (4.4%)	47 (3.8%)	64 (4.6%)	
Madeira	18 (1.8%)	35 (2.8%)	34 (2.4%)	
Azores	18 (1.8%)	28 (2.3%)	22 (1.6%)	
Town size	**2015**	**2020**	**2023**	
Small	499 (48.5%)	572 (46.5%)	663 (47.7%)	
Medium	0 (0.0%)	0 (0.0%)	462 (33.2%)	
Large	529 (51.5%)	657 (53.5%)	266 (19.1%)	

Table A1. *Cont.*

Panel B. Financial literacy (objective and perceived).						
Objective Items	**Wave**	**Percent Correct**	***N***			
LF_Diver	2015	73.7	1028			
	2020	49.9	1229			
	2023	47.9	1391			
LF_JC	2015	40.7	1028			
	2020	34.5	1229			
	2023	48.4	1391			
LF_JS	2015	59.9	1028			
	2020	46.3	1229			
	2023	41.3	1391			
LF_div	2015	88.9	1028			
	2020	77.0	1229			
	2023	80.2	1391			
LF_inf	2015	53.8	1028			
	2020	58.4	1229			
	2023	56.8	1391			
LF_jur25	2015	87.9	1028			
	2020	88.5	1229			
	2023	93.1	1391			
LF_over	2015	83.0	1028			
	2020	67.5	1229			
	2023	78.5	1391			
LF_over_seg	2015	60.0	1028			
	2020	39.9	1229			
	2023	48.0	1391			
LF_riskret	2015	81.6	1028			
	2020	76.4	1229			
	2023	75.3	1391			
Perceived financial literacy (PFL)						
Wave	**Mean**	***SD***	***N***			
2015	3.44	1.21	1028			
2020	3.61	1.17	1229			
2023	3.56	1.16	1391			
Panel C. Composites (*OFW*, *BC*).						
Composite	**Wave**	**Mean**	***SD***	***Min***	***Max***	***N***
OFW	2015	−0.005	0.762	−1.381	2.606	1028
	2020	−0.005	0.773	−1.380	2.253	1229
	2023	−0.007	0.775	−1.436	2.605	1391
BC	2015	−0.014	0.505	−1.333	2.009	1028
	2020	−0.023	0.527	−0.979	1.912	1229
	2023	−0.021	0.590	−1.106	2.233	1391

Table A1. *Cont.*

Panel D. Psychometric indicators for SEM.				
Perceived financial capability (PC)				
Variable	**Wave**	**Mean**	***SD***	***N***
on_time	2015	4.18	0.82	1028
	2020	4.69	0.67	1229
	2023	4.56	0.73	1391
ability (reversed in SEM)	2015	3.38	1.12	1028
	2020	3.19	1.19	1229
	2023	2.93	1.15	1391
risk_prepared	2015	3.08	1.26	1028
	2020	3.27	1.22	1229
	2023	3.34	1.18	1391
Subjective financial wellbeing (SFW)				
Variable	**Wave**	**Mean**	***SD***	***N***
satisfied	2015	2.82	1.24	1028
	2020	2.86	1.18	1229
	2023	3.04	1.06	1391
control	2015	4.07	0.86	1028
	2020	4.02	0.99	1229
	2023	3.92	0.88	1391
debt (reversed in SEM)	2015	1.90	1.01	1028
	2020	1.77	0.99	1229
	2023	1.93	0.87	1391
worry (reversed in SEM)	2015	3.38	1.16	1028
	2020	3.31	1.37	1229
	2023	2.83	1.27	1391
Negative impulsive bias (NIB)				
Variable	**Wave**	**Mean**	***SD***	***N***
impulse (reversed in SEM)	2015	2.27	1.04	1028
	2020	1.71	0.96	1229
	2023	1.63	0.86	1391
ponder	2015	4.47	0.65	1028
	2020	4.44	0.90	1229
	2023	4.01	1.27	1391
long_term	2015	3.44	1.08	1028
	2020	3.29	1.21	1229
	2023	2.93	1.14	1391
today (reversed in SEM)	2015	2.36	1.13	1028
	2020	2.45	1.12	1229
	2023	2.29	1.00	1391

Note: Household income is ordinal 1–5; *SD* = Standard deviation; *Min* = Minimum; *Max* = Maximum; *N* = Frequency.

References

Abreu, M., Mendes, V., & Coutinho dos Santos, M. (2025). Financial literacy, financial resilience and participation in securities markets: Evidence from Portugal. *Journal of Risk and Financial Management*, *18*(12), 677. [CrossRef]

Amores, A. F., Basso, H. S., Bischl, J. S., De Agostini, P., Poli, S. D., Dicarlo, E., Flevotomou, M., Freier, M., Maier, S., García-Miralles, E., Pidkuyko, M., Ricci, M., & Riscado, S. (2023). *Inflation, fiscal policy and inequality* (ECB Occasional Paper No. 2023/330). European Central Bank (ECB). [CrossRef]

Atkinson, A., McKay, S., Collard, S., & Kempson, E. (2007). Levels of financial capability in the UK. *Public Money & Management*, *27*(1), 29–36. [CrossRef]

Brüggen, E. C., Hogreve, J., Holmlund, M., Kabadayi, S., & Löfgren, M. (2017). Financial well-being: A conceptualization and research agenda. *Journal of Business Research*, *79*, 228–237. [CrossRef]

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica: Journal of the Econometric Society*, *28*(3), 591–605. [CrossRef]

Collins, J. M., & Urban, C. (2020). Measuring financial well-being over the lifecourse. *The European Journal of Finance*, *26*(4–5), 341–359. [CrossRef]

Consumer Financial Protection Bureau. (2015). *Financial well-being: The goal of financial education*. Available online: https://www.consumerfinance.gov/data-research/research-reports/financial-well-being/ (accessed on 1 February 2026).

Croon, M. (2014). Using predicted latent scores in general latent structure models. In *Latent variable and latent structure models* (pp. 195–223). Psychology Press.

Cupák, A., Kolev, G. I., & Brokešová, Z. (2019). Financial literacy and voluntary savings for retirement: Novel causal evidence. *The European Journal of Finance*, *25*(16), 1606–1625. [CrossRef]

Devlieger, I., Mayer, A., & Rosseel, Y. (2016). Hypothesis testing using factor score regression: A comparison of four methods. *Educational and Psychological Measurement*, *76*(5), 741–770. [CrossRef] [PubMed]

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of Marketing Research*, *38*(2), 269–277. [CrossRef]

Fan, L., & Henager, R. (2022). A structural determinants framework for financial well-being. *Journal of Family and Economic Issues*, *43*(2), 415–428. [CrossRef] [PubMed]

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and meas-urement error. *Journal of Marketing Research*, *18*(1), 39–50. [CrossRef]

Frigerio, M., Ottaviani, C., & Vandone, D. (2020). A meta-analytic investigation of consumer over-indebtedness: The role of impulsivity. *International Journal of Consumer Studies*, *44*(4), 328–342. [CrossRef]

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. [CrossRef]

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Publications.

Lone, U. M., & Bhat, S. A. (2024). Impact of financial literacy on financial well-being: A mediational role of financial self-efficacy. *Journal of Financial Services Marketing*, *29*(1), 122–137. [CrossRef]

Lusardi, A., & Mitchell, O. S. (2011). Financial literacy and retirement planning in the United States. *Journal of Pension Economics & Finance*, *10*(4), 509–525. [CrossRef]

Lusardi, A., & Streeter, J. L. (2023). Financial literacy and financial well-being: Evidence from the US. *Journal of Financial Literacy and Wellbeing*, *1*(2), 169–198. [CrossRef]

Pallotti, F., Paz-Pardo, G., Slacalek, J., Tristani, O., & Violante, G. L. (2024). Who bears the costs of inflation? Euro area households and the 2021–2023 shock. *Journal of Monetary Economics*, *148*, 103671. [CrossRef]

Panos, G. A., & Wilson, J. O. S. (2020). Financial literacy and responsible finance in the FinTech era: Capabilities and challenges. *The European Journal of Finance*, *26*(4–5), 297–301. [CrossRef]

Philippas, N. D., & Avdoulas, C. (2020). Financial literacy and financial well-being among generation-Z university students: Evidence from Greece. *The European Journal of Finance*, *26*(4–5), 360–381. [CrossRef]

Rhemtulla, M., Brosseau-Liard, P. É., & Savalei, V. (2012). When can categorical variables be treated as continuous? A comparison of robust continuous and categorical SEM estimation methods under suboptimal conditions. *Psychological Methods*, *17*(3), 354. [CrossRef] [PubMed]

Rigdon, E. E. (1998). The equal correlation baseline model for comparative fit assessment in structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, *5*(1), 63–77. [CrossRef]

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(1), 1–36. [CrossRef]

Sabri, M. F., Wahab, R., Mahdzan, N. S., Magli, A. S., & Rahim, H. A. (2022). Mediating effect of financial behaviour on the relationship between perceived financial wellbeing and its factors among low-income young adults in Malaysia [original research]. *Frontiers in Psychology*, *13*, 858630. [CrossRef] [PubMed]

Saeedi, S. E., & Nishad, T. M. (2024). Financial well-being and financial behavior: A bibliometric analysis. *SN Business & Economics*, *4*(12), 162. [CrossRef]

Sharma, V., Kumar, R., Jain, J., & Ahuja, P. (2024). Mapping the literature on financial satisfaction: A systematic literature review and bibliometric analysis. *Qualitative Research in Financial Markets*, *18*(1), 105–138. [CrossRef]

Sherraden, M. (2013). Building blocks of financial capability. In J. Birkenmaier, J. Curley, & M. Sherraden (Eds.), *Financial capability and asset development: Research, education, policy, and practice* (pp. 3–43). Oxford University Press. [CrossRef]

Shi, W., Ali, M., & Leong, C.-M. (2024). Dynamics of personal financial management: A bibliometric and systematic review on financial literacy, financial capability and financial behavior. *International Journal of Bank Marketing*, *43*(1), 125–165. [CrossRef]

Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of cronbach's alpha. *Psychometrika*, *74*(1), 107–120. [CrossRef] [PubMed]

Singh, D., & Malik, G. (2022). A systematic and bibliometric review of the financial well-being: Advancements in the current status and future research agenda. *International Journal of Bank Marketing*, *40*(7), 1575–1609. [CrossRef]

Skagerlund, K., Lind, T., Strömbäck, C., Tinghög, G., & Västfjäll, D. (2018). Financial literacy and the role of numeracy—How individuals' attitude and affinity with numbers influence financial literacy. *Journal of Behavioral and Experimental Economics*, *74*, 18–25. [CrossRef]

Skrondal, A., & Laake, P. (2001). Regression among factor scores. *Psychometrika*, *66*(4), 563–575. [CrossRef]

Tahir, M. S., Ahmed, A. D., & Richards, D. W. (2021). Financial literacy and financial well-being of Australian consumers: A moderated mediation model of impulsivity and financial capability. *International Journal of Bank Marketing*, *39*(7), 1377–1394. [CrossRef]

Taylor, M. (2011). Measuring financial capability and its determinants using survey data. *Social Indicators Research*, *102*(2), 297–314. [CrossRef]

van Raaij, W. F., Riitsalu, L., & Põder, K. (2023). Direct and indirect effects of self-control and future time perspective on financial well-being. *Journal of Economic Psychology*, *99*, 102667. [CrossRef]

Xiao, J. J., Huang, J., Goyal, K., & Kumar, S. (2022). Financial capability: A systematic conceptual review, extension and synthesis. *International Journal of Bank Marketing*, *40*(7), 1680–1717. [CrossRef]